FIG. 1

System Architecture

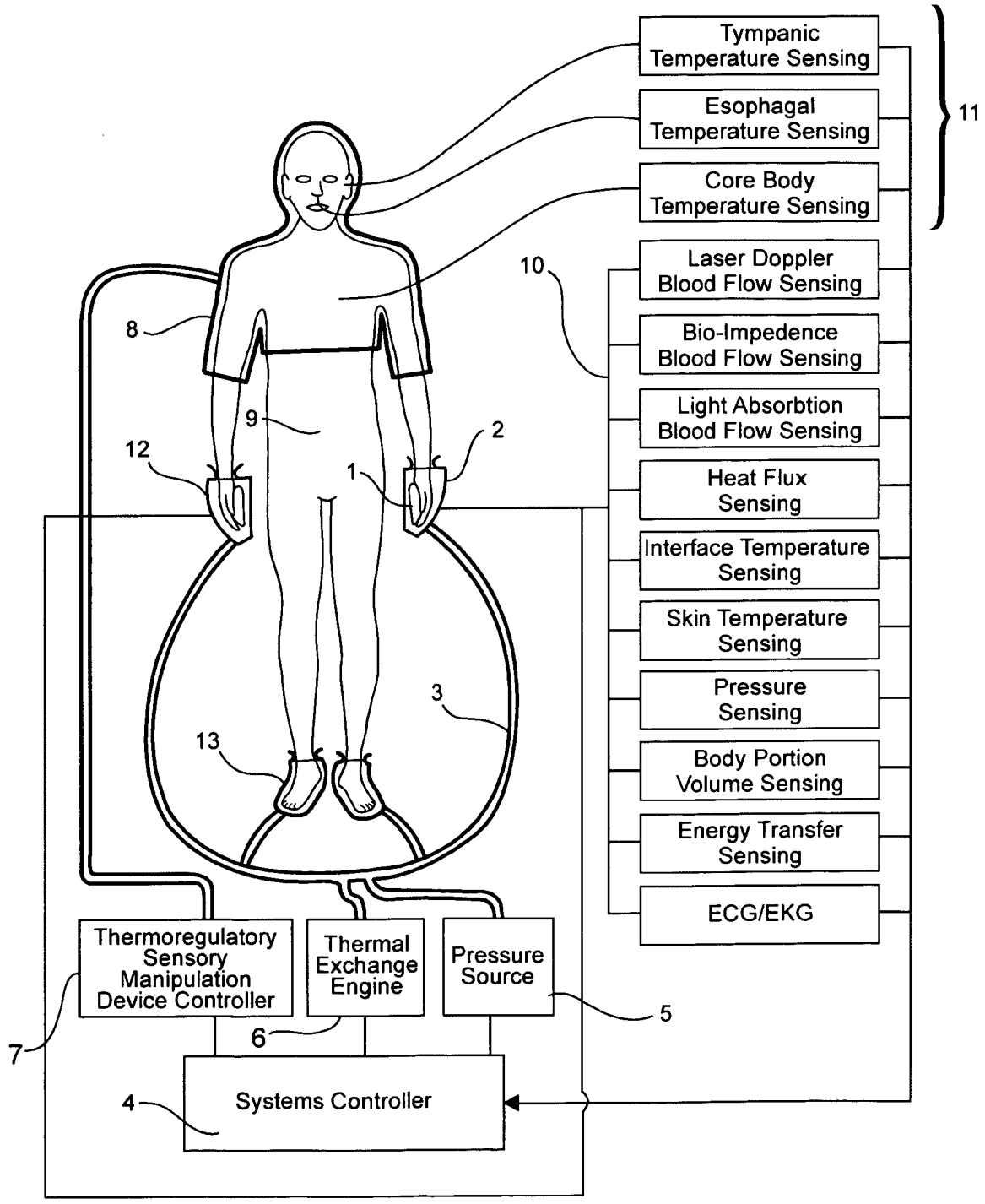


FIG. 2

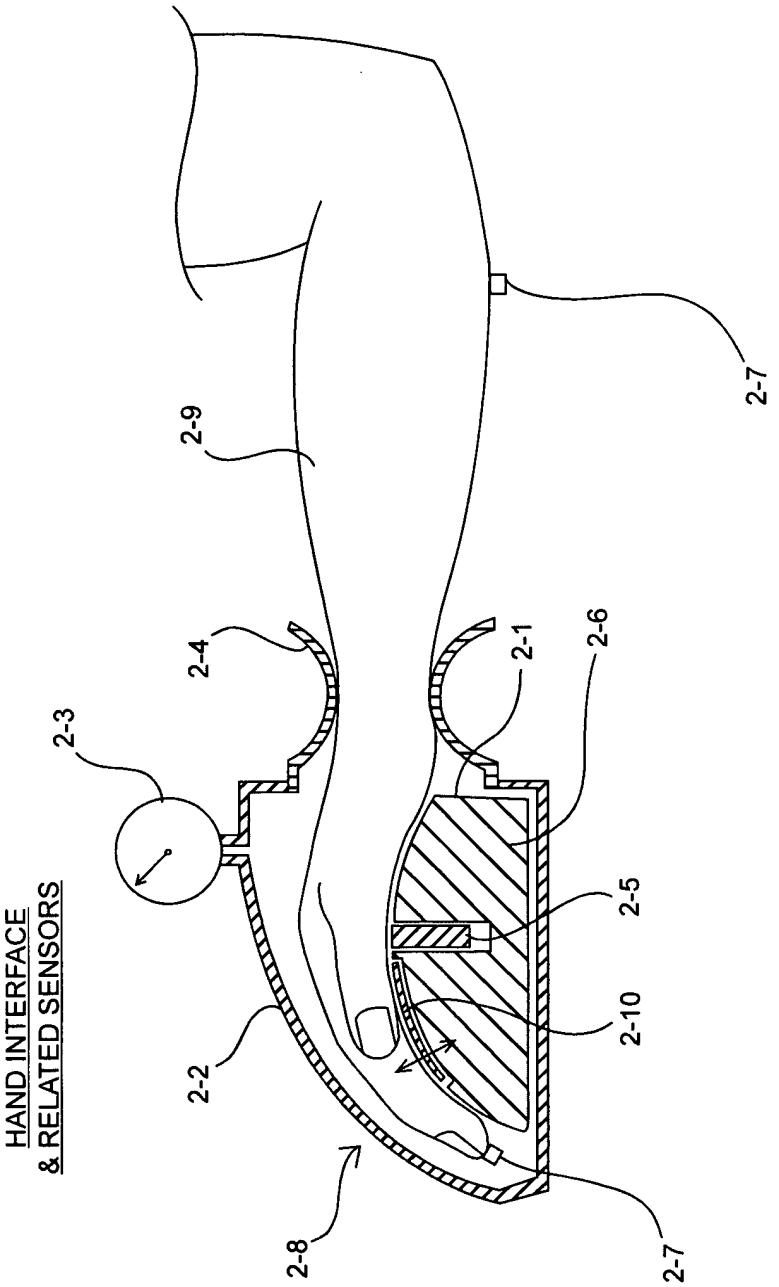

HAND INTERFACE
& RELATED SENSORS
2-3
2-4
2-9
2-7
2-1
2-6
2-5
2-10
2-2
2-8
2-7

FIG. 3

FOOT INTERFACE
& RELATED SENSORS

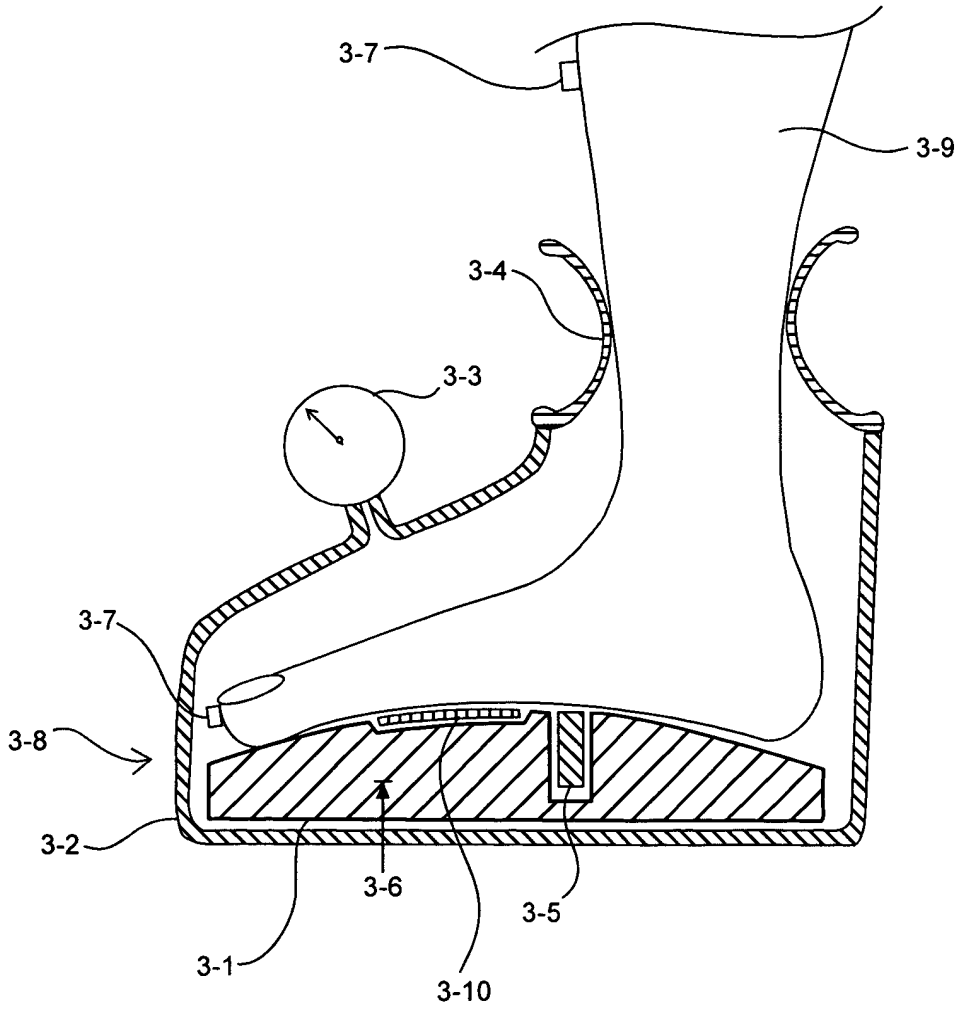


FIG. 4B

HEAD, SHOULDERS, CHEST, BACK, TORSO AND ARMS

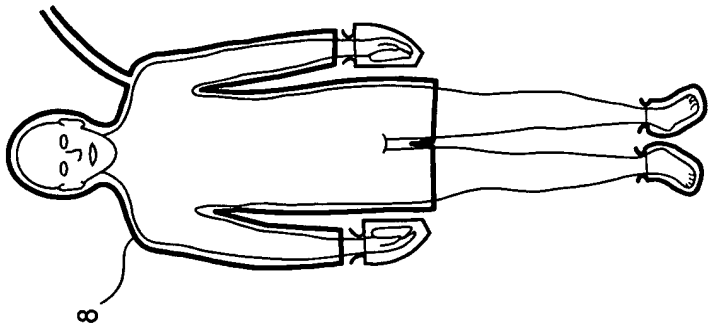


FIG. 4A

THE ENTIRE SKIN SURFACE

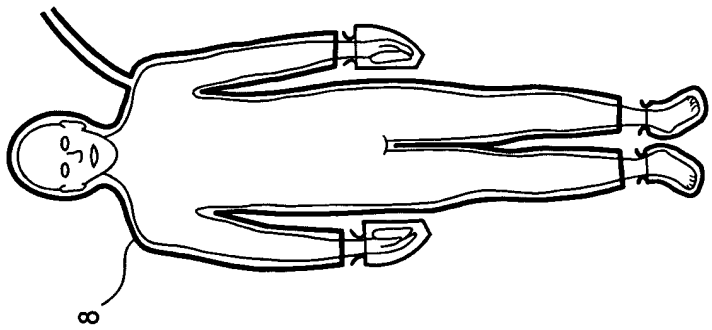


FIG. 4D

HEAD, SHOULDERS, CHEST AND BACK

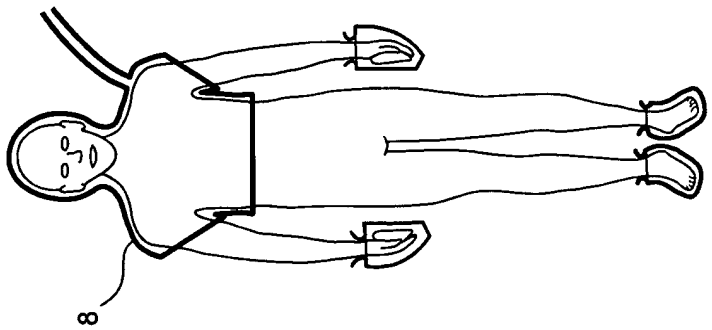


FIG. 4C

HEAD, SHOULDERS, CHEST, BACK AND ARMS

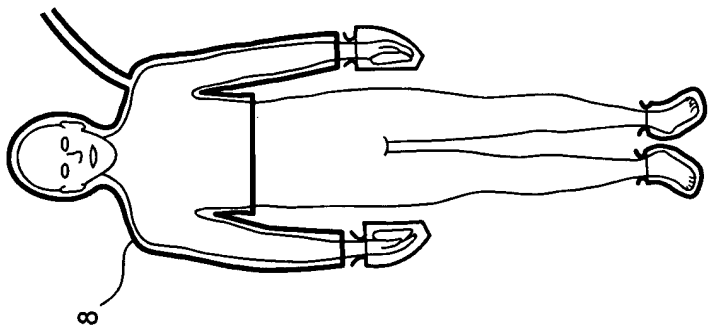


FIG. 4F

SHOULDERS, CHEST, BACK AND TORSO

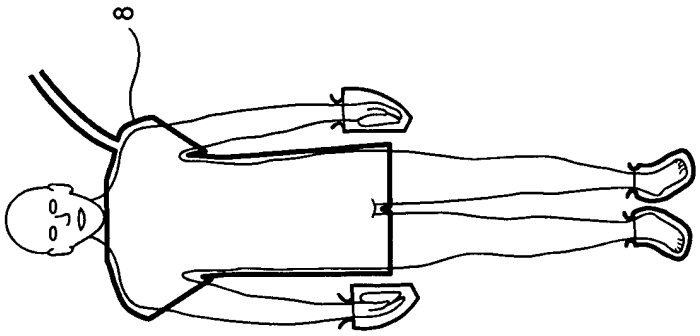


FIG. 4E

SHOULDERS, CHEST, BACK AND ARMS

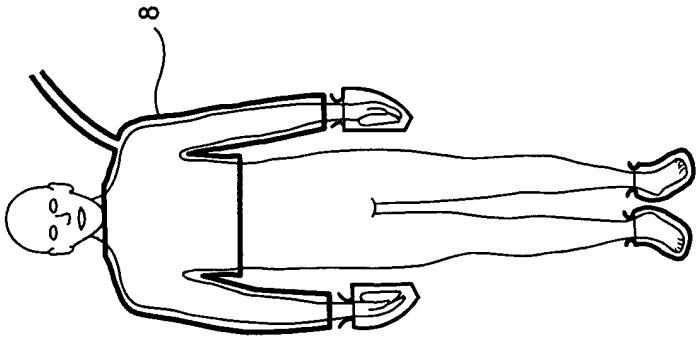


FIG. 4H

TORSO AND LEGS

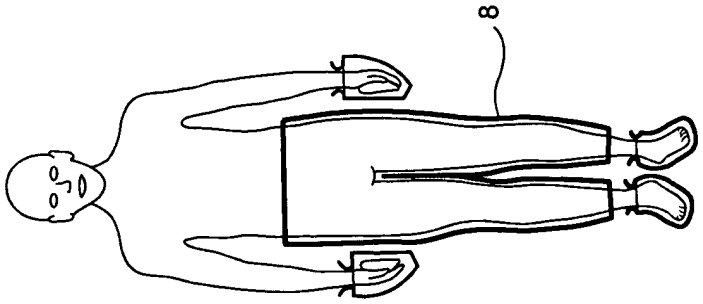


FIG. 4G

CHEST, BACK, TORSO AND LEGS

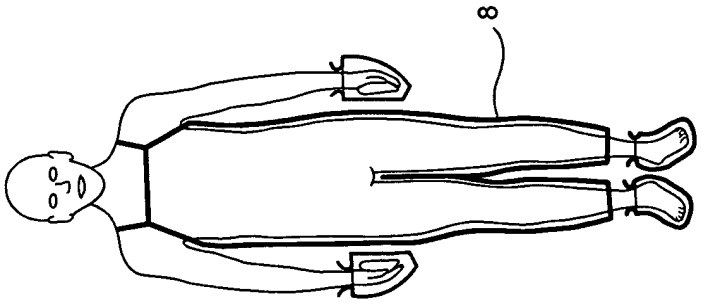


FIG. 5

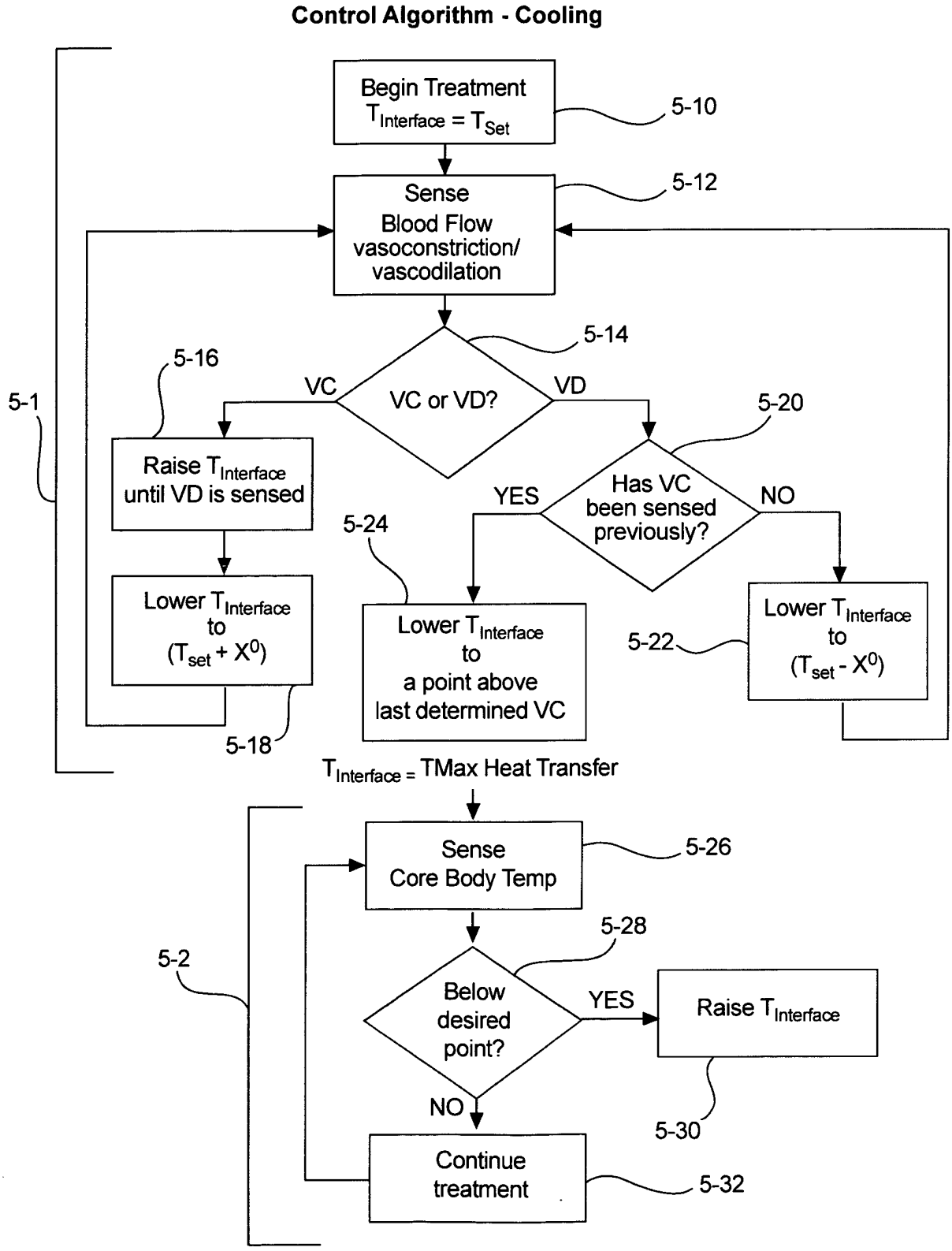
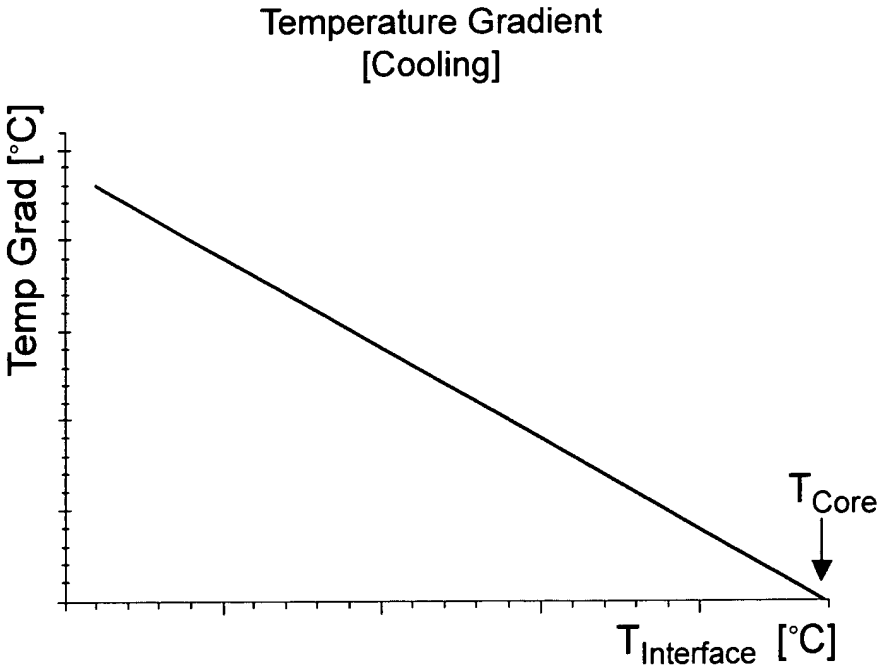

Control Algorithm - Cooling
Begin Treatment
$T_{Interface} = T_{Set}$
5-10
Sense
Blood Flow
vasoconstriction/
vascodilation
5-12
5-14
VC or VD?
VC
VD
5-16
5-1
Raise $T_{Interface}$
until VD is sensed
5-20
Has VC
been sensed
previously?
YES
NO
5-24
Lower $T_{Interface}$
to
$(T_{set} + X^0)$
Lower $T_{Interface}$
to
a point above
last determined VC
5-22
Lower $T_{Interface}$
to
$(T_{set} - X^0)$
5-18
$T_{Interface}$ = TMax Heat Transfer
Sense
Core Body Temp
5-26
5-28
5-2
Below
desired
point?
YES
Raise $T_{Interface}$
5-30
NO
Continue
treatment
5-32

FIG. 6

$T_{Interface}$ affects Vasoconstriction & Vasodilation

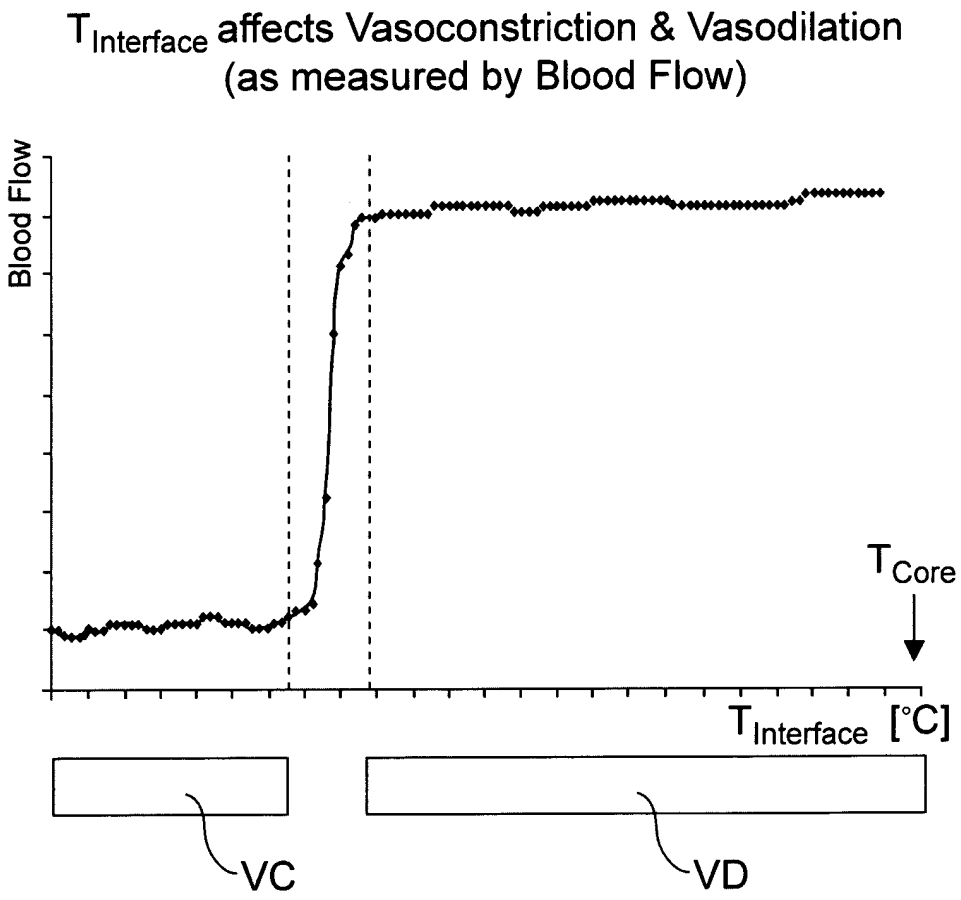


ΔT = Temperature Gradient $\equiv |T_{Core} - T_{Interface}|$

is the Driving Force in: Heat Transfer at the Thermal Interface

- Cooling: $T_{Interface} < T_{Core}$
- Warming: $T_{Interface} > T_{Core}$

FIG. 7



For each individual,

•Vasoconstriction [VC] occurs below a certain Temp range

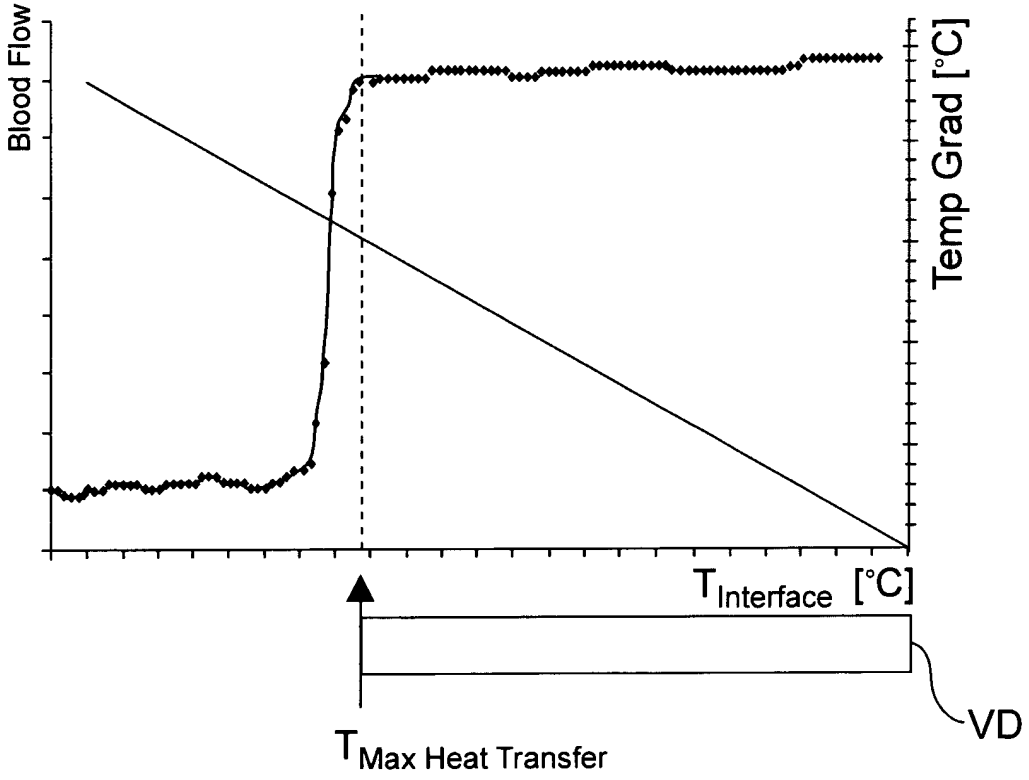
•Vasoconstriction [VD] occurs above that Temp range

Blood Flow can be measured by:

- Laser Doppler
- Bio-Impedance
- Light Absorbtion (Pulse Oximetry)

FIG. 8

Heat Transfer = *f* (Temp Grad x Blood Flow)
Figure shows Temp Grad & Blood Flow vs. $T_{Interface}$ superimposed

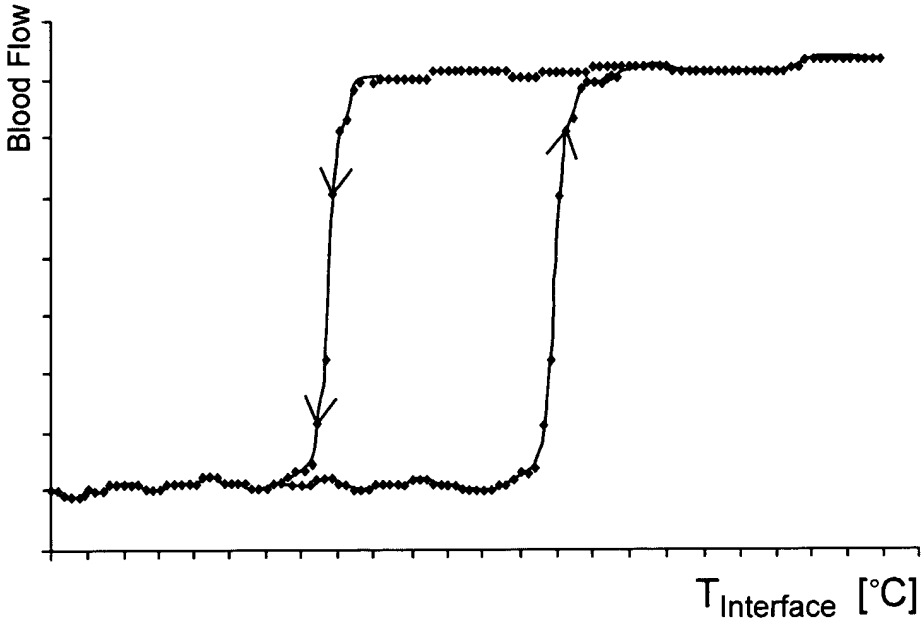


Maximum Heat Transfer
occurs @

The lowest $T_{Interface}$ where
Vasodilation occurs

FIG. 9

Hysterysis:



The transition between Vasoconstriction and Vasodilation is

NOT Identically Reversible...

The transition occurs at a different temperature range depending on the initial condition

Typically, the transition from:

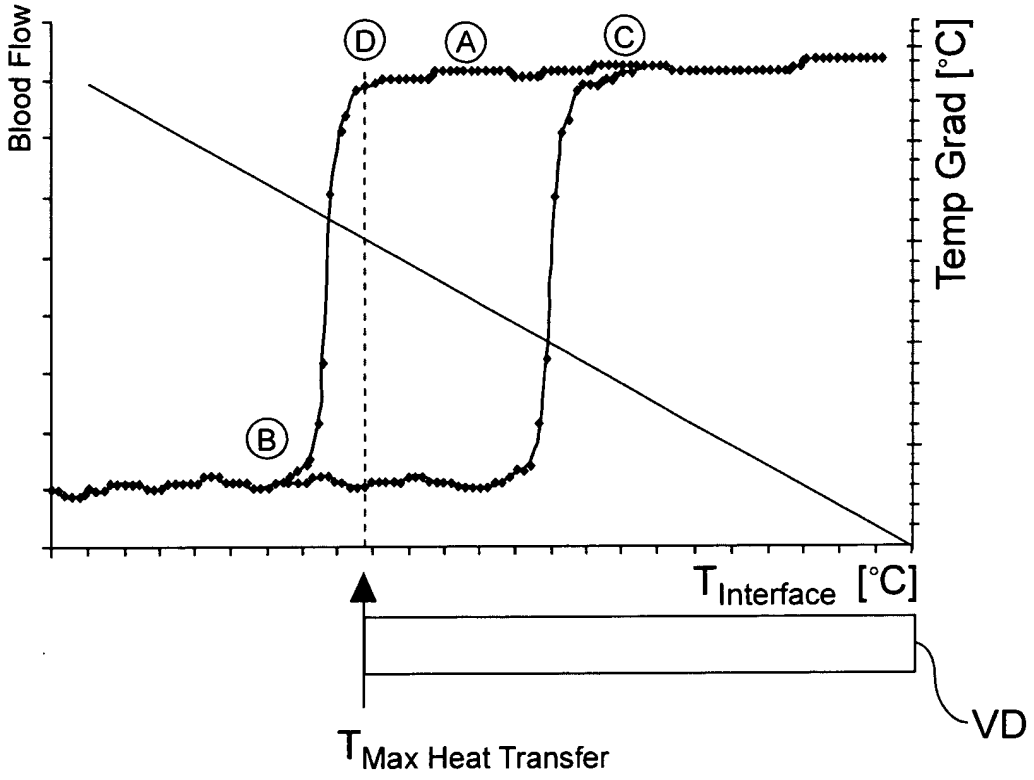
$VC \longrightarrow VD$

occurs at a $T_{Interface}$ range above

$VD \longrightarrow VC$

FIG. 10

If Vasodilation is initially detected



Ⓐ Blood Flow Sensor detects VD, $T_{Interface} = T_{set}$

Ⓑ System controller decreases $T_{Interface}$ until VC detected

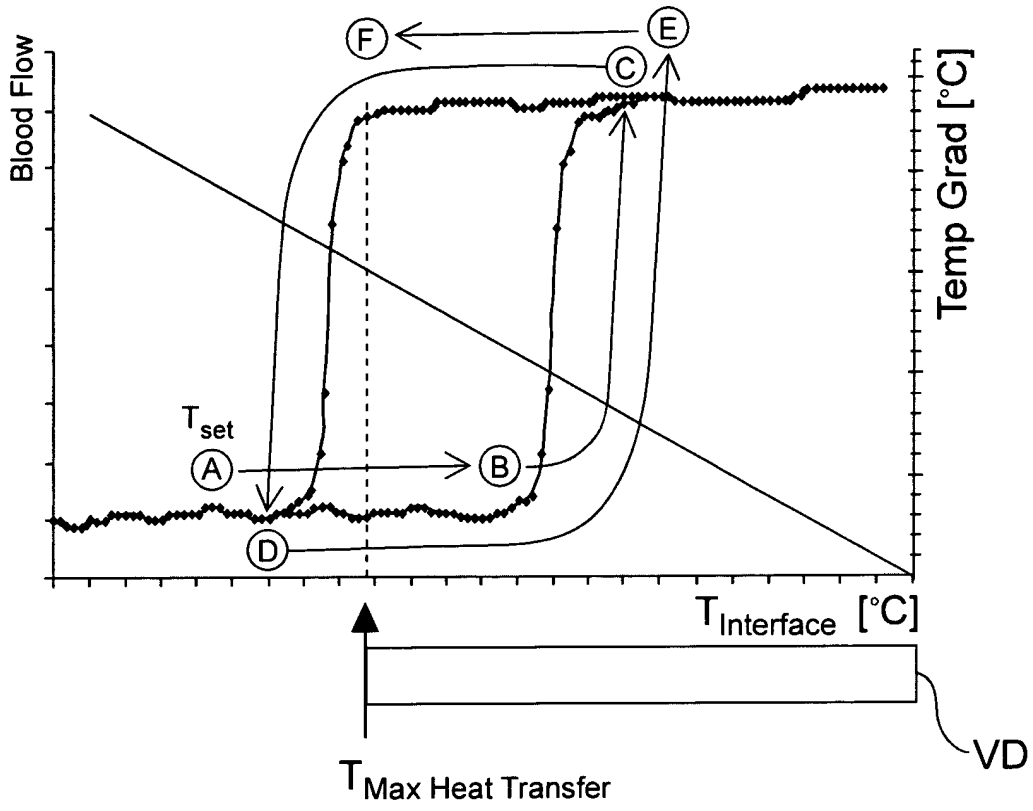
Ⓒ $T_{Interface}$ increases above transition temp range, VD occurs

Ⓓ System controller decreases $T_{Interface}$ to $T_{Max\ Heat\ Transfer}$

$T_{Max\ Heat\ Transfer} < T_{set}$

FIG. 11

If Vasoconstriction is initially detected



(A) Blood Flow Sensor detects VC, $T_{Interface} = T_{set}$

(B) System controller increases $T_{Interface}$

(C) $T_{Interface}$ increases above transition temp range, VD occurs

(D) System controller decreases $T_{Interface}$ to $T_{Max\ Heat\ Transfer}$

$$T_{Max\ Heat\ Transfer} > T_{set}$$